



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/986,722	11/09/2001	Shinji Yamasaki	0707-0152P	5861

2292 7590 07/18/2003

BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

EXAMINER

CHANEY, CAROL DIANE

ART UNIT	PAPER NUMBER
----------	--------------

1745

DATE MAILED: 07/18/2003

3

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/986,722

Applicant(s)

YAMASAKI ET AL.

Examiner

Carol Chaney

Art Unit

1745

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 November 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2 and 4-20 is/are rejected.
- 7) ☒ Claim(s) 3 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 09/011,532.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2. 6) ☐ Other:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 4, 5, 7, 8-12, 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neat et al. (US Patent 5,464,708) in view of Fong et al. (US Patent 5,028,500) and Moses et al., US (Patent 5,948,569).

Applicants' claims are directed to a method of making a lithium secondary batteries. Applicants invention includes assembling a battery having lithium titanate as the cathode material, a carbonaceous anode material, an electrolyte with an organic solvent, and then doping lithium into the anode material. Applicants' claim 2 further limits the doping process to placing metallic lithium in the cell. Applicants' claim 4 limits the claimed cathode composition to $\text{Li}_x\text{Ti}_y\text{O}_4$ with $0.8 \leq x \leq 1.4$, and $1.6 \leq y \leq 2.2$. It is noted that this empirical formula is equivalent to the formula $\text{Li}_x\text{Ti}_y\text{O}_2$ with $0.4 \leq x \leq 0.7$, and $0.8 \leq y \leq 1.1$.

Neat et al. disclose lithium secondary batteries having Li_xTiO_2 with x greater than 0.5 and less than 1.0 as a cathode active material. (Note column 1, lines 23-35.) An electrolyte comprising a complex of LiCF_3SO_3 and polyethylene oxide, which would be a solution of a lithium salt in an organic solvent, is disclosed. (Note column 1, lines 36-39.) Electrolyte solvents using propylene carbonate are disclosed. (Column 1, lines 16-20.) Electrodes comprising titanium dioxide as the active material, ketjen carbon black

as a conductive aid, and a polyethylene oxide/lithium salt solution as a binder are disclosed. (Note column 1, lines 63-67.)

The disclosure of Neat et al. differs from the applicants' disclosure in that Neat et al. does not teach or suggest using carbonaceous or graphitic material as the anode active material and doping the anode material with lithium. Fong et al. teach that secondary lithium batteries using metallic lithium as the anode active material have the disadvantages of: a) dendritic lithium growths occurring and shorting the battery; b) the high reactivity and low melting point of lithium metal resulting in a meltdown of the battery anode and c) the concurrent use of toxic lithium salts in the battery electrolyte. (Note column 1, lines 26-31 and column 1, line 67-column 2, line 16.) Fong et al. further teach that these disadvantages may be avoided by replacing the lithium metal anode with a lithium intercalated coke or graphite carbon anode. (Note column 2, lines 20-24.)

Moses et al. teach that the irreversible capacity loss of lithium secondary batteries with lithium transition metal oxide cathodes materials and carbon anode materials can be reduced by including a deposit of a Group I element between the positive and negative electrodes of the cell. (Column 4, lines 44-48.) Lithium metal-coated carbon is used in an exemplary embodiment. (Column 7, Example 2.) Therefore, it would have been obvious to one of ordinary skill in the art to modify the battery disclosed by Neat et al. by first replacing the metallic lithium anode with a carbon anode, because Fong et al. teach that carbon anodes avoid some of the disadvantages of lithium metal anodes and second, coating the carbon anode with lithium because Moses et al. teach that this will minimize irreversible capacity loss of the battery.

Claims 1, 2, and 4-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohzuku et al. (*J. Electrochem. Soc.*, Vol. 142, No. 5, May 1995, pp. 1431-1435) in view of Fong et al. (US Patent 5,028,500) and Moses et al., US (Patent 5,948,569).

Ohzuku et al. disclose $\text{Li}/\text{Li}[\text{Li}_{1/3}\text{Ti}_{5/3}]\text{O}_4$ cells. The electrolyte used in the cells is 1M LiClO_4 dissolved in ethylene carbonate/dimethoxyethane solvent. The cathodes are formed from 88 w/o lithium titanate, 6 w/o of acetylene black, which is a conductive aid, and 6 w/o of TEFLON, which is a binder. (Note Fig. 3, page 1433 and page 1431, second column, second paragraph.) Ohzuku et al. disclose forming lithium titanate by heating anatase and lithium hydroxide at 800 °C. (Page 1431, column 1, "Experimental" section.)

The disclosure of Ohzuku et al. differs from applicants' claims in that Ohzuku et al. do not disclose cells using $\text{Li}[\text{Li}_{1/3}\text{Ti}_{5/3}]\text{O}_4$ as the cathode active material and carbon as the anode active material. However, Ohzuku et al. suggest lithium titanate cathode active materials would be appropriate for "shuttlecock" or "rocking chair" batteries in which both the anode and cathode materials are intercalation compounds. (Note page 1431, first paragraph, and page 1434, last paragraph.) Fong et al., as discussed above, teach lithium secondary batteries with carbon anodes can overcome disadvantages associated with lithium metal anodes, and Moses et al. teach that the irreversible capacity loss of lithium secondary batteries having lithium transition metal oxide cathodes materials and carbon anode materials can be reduced by including a deposit of a Group I element between the positive and negative electrodes of the cell. Therefore, it would have been obvious to one of ordinary skill in the art to modify the battery disclosed by Ohzuku et al. by first replacing the metallic lithium anode with a carbon anode, because Fong et al. teach that carbon anodes avoid some of the disadvantages of lithium metal anodes and then coating the carbon anode with lithium

because Moses et al. teach that this will minimize irreversible capacity loss of the battery.

Allowable Subject Matter

Claim 3 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The prior art does not suggest placing metallic lithium in an amount corresponding to about 80% of the electric capacity of the cathode in a cell with lithium titanate as the cathode. Moses et al. suggest using relatively small amounts of lithium, and thus effectively teach away from this limitation.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following prior art disclose composite anodes with lithium metal in lithium ion batteries.

Herr, US Patent 6,025,093.

Asuanuma et al., US Patent 6,001,139.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carol Chaney whose telephone number is (703) 305-3777. The examiner can normally be reached on Mon - Fri 8:00am-4:30pm.

Art Unit: 1745

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 703-308-2383. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.



Carol Chaney
Primary Examiner
Art Unit 1745

cc
July 12, 2003